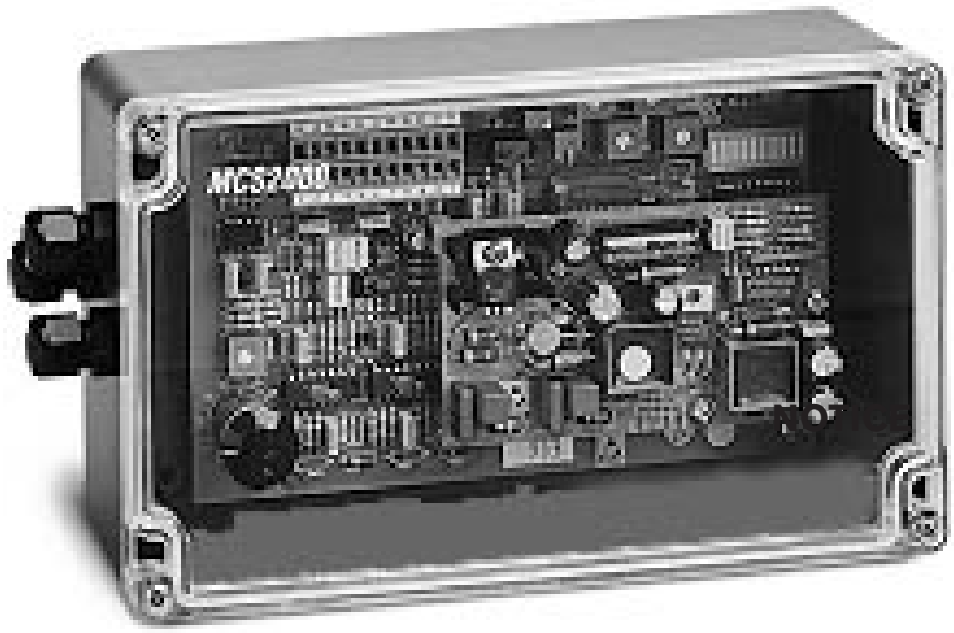
MCS2000-IS

INTERFACE FOR LOADCELL AND ULTRASONIC SENSORS



USER MANUAL

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General description

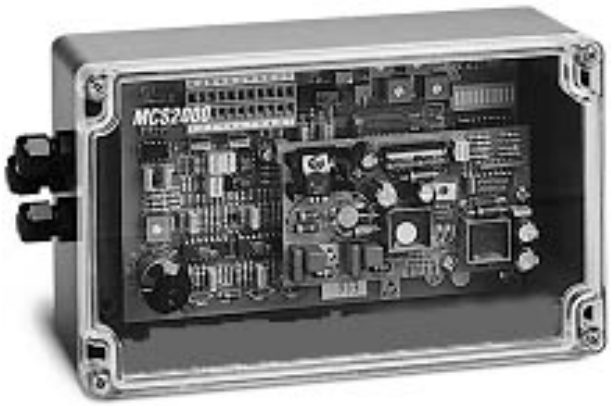
The interface sensor MCS2000-IS integrates two basic functions.

Amplifier with averaging function for two load cells

The unit can be connected either to one or two load cells. Two high gain and stability amplifiers are able to amplify signal load cell as low as 10 mV with very high precision in order to get a normalised 0-10V output. Each amplifier has a separated gain adjustment and individual offset setting. Special care was brought in the IC selection to insure a long-term stability and to guarantee precision in large temperature range. As the amplifier owns very sensitive input it is recommended to mount it as close as possible from load cells. We recommend not going over 5 m. In case of use of WARNER load cell an appropriated shielded cable is supplied. In other case it is of customer responsibility to use a correct connection cable between the load cells and the unit MCS2000-IS. The block schematic included in the present manual will provide all information about the installed functions.

Ultrasonic calibration stage with derivative compensation

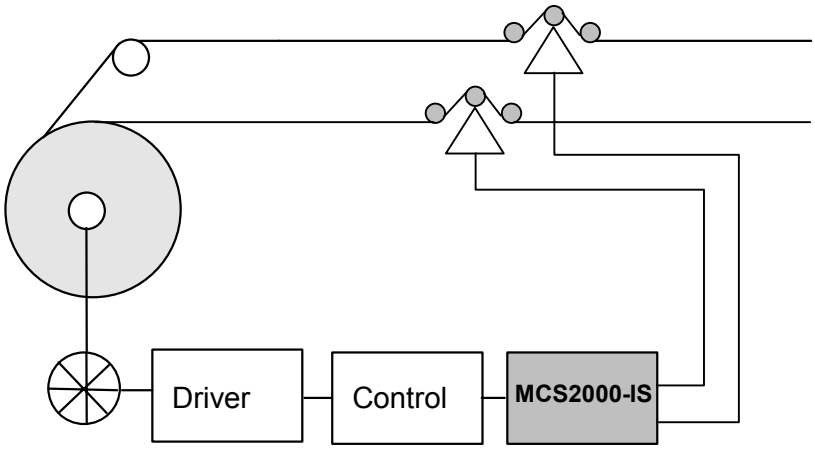
One ultrasonic sensor or any other voltage source can be connected to the unit. The calibration stage is able to provide an output signal 0-10 V whatever the input voltage change provided this input variation is at least 1 V regardless polarity slope but necessarily comprised into the range 0-10V. An output stage is installed where the calibrated signal can be added to other information such a dV/dt compensation signal.
This function is mainly used when the MCS2000-IS is used in open loop with roll diameter measurement. The line speed dV/dt can be added or subtracted to the main signal during acceleration and deceleration
The block schematic will inform you about the complete functions of the unit.



As the MCS2000-IS unit must be installed as close as possible from load cells it has been voluntary built in a rugged housing allowing its installation on the machine frame

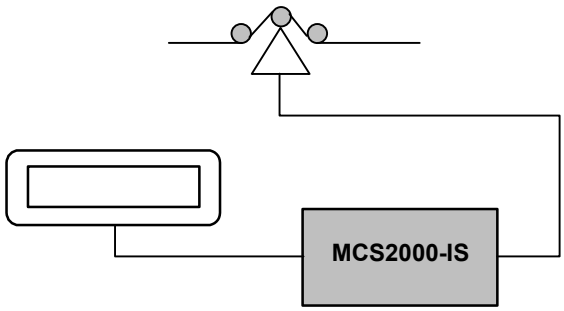
Typical MCS2000-IS application

In closed loop as load cell amplifier for unwinding system



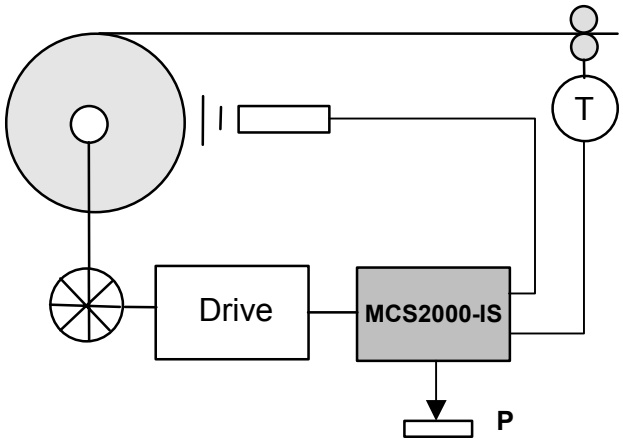
Tension in the WEB is measured with 2 load cells. The interface IS amplifies the 2 signals coming from the load cells and delivers an averaged value of the tension to the closed loop controller. One digital indicator shows in continue the measured value to the operator. One remote indication is possible too.

As tension indicator in open loop



Simple example where the tension in the WEB is measured by a load cell and just displayed. The MCS2000-IS is calibrated to deliver a 0 – 10 V signal to an appropriate display

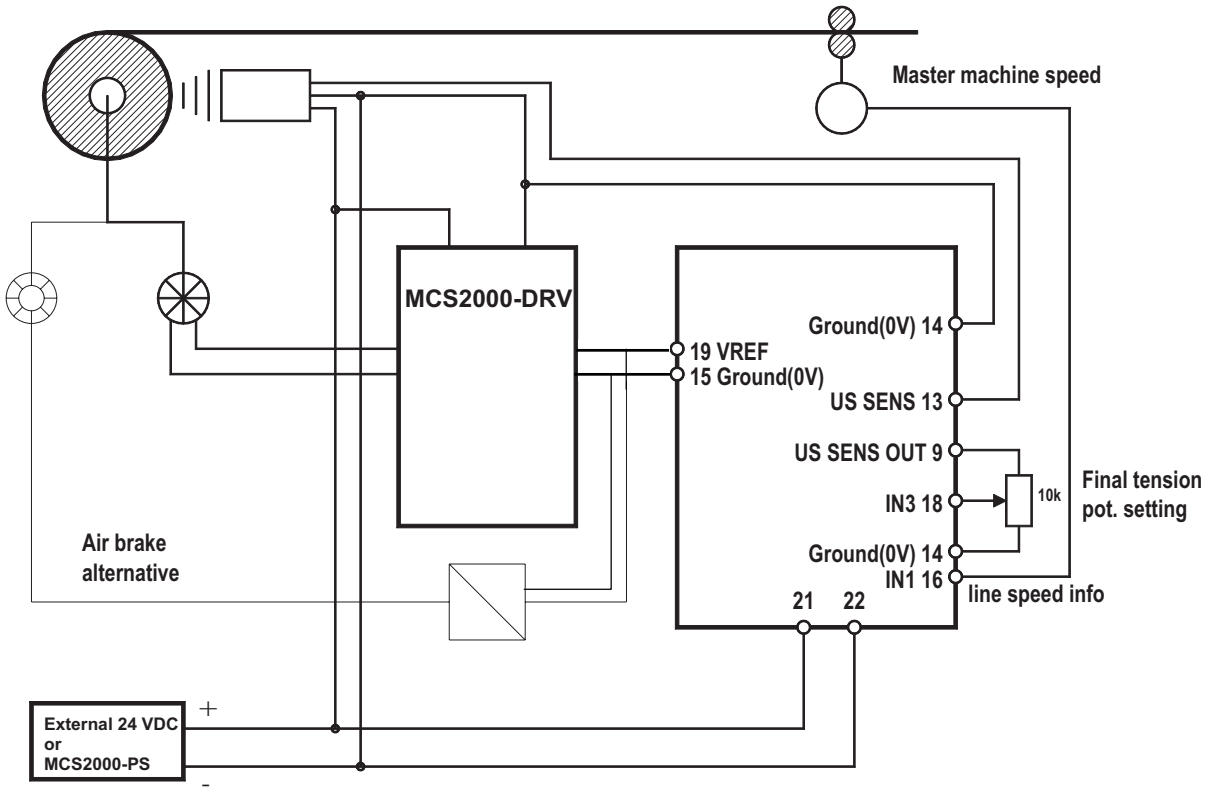
As reference for open loop control in the unwind system



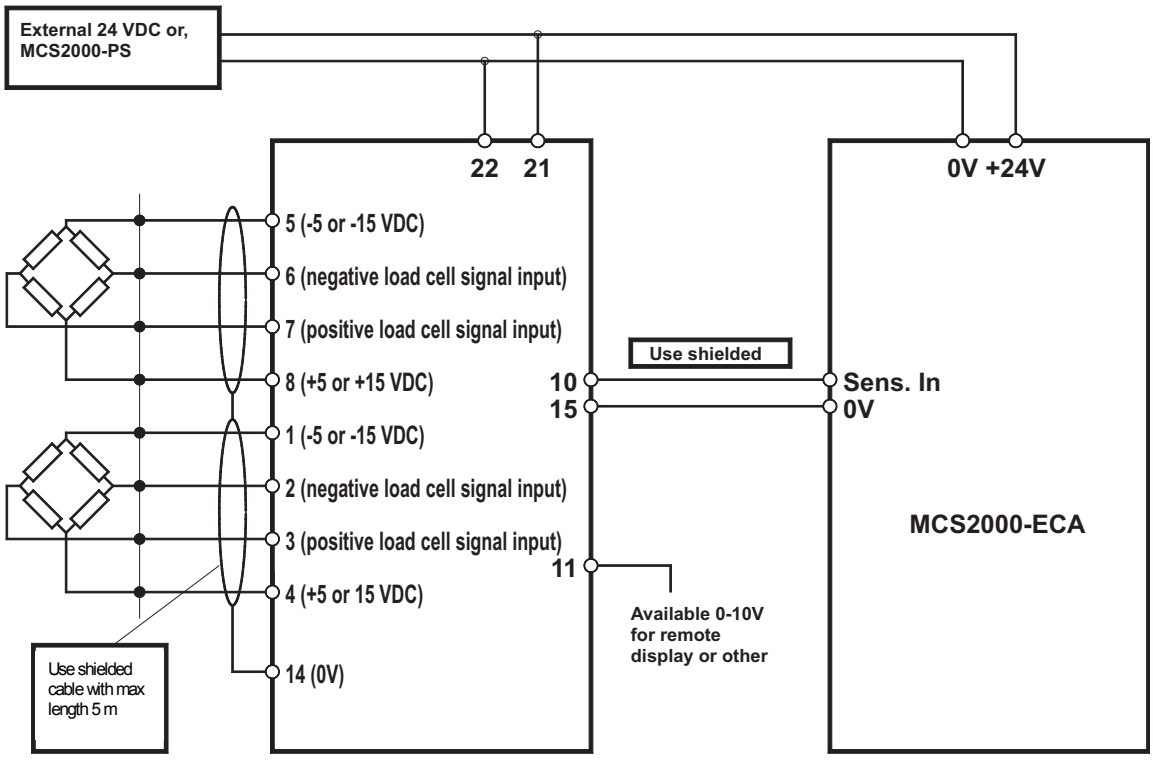
The diameter of the roll is measured by an ultrasonic sensor. The MCS2000-IS is calibrating this signal and translate it into a true diameter information. The line speed information delivered y the tacho-generator is used to create a dV/dt compensation during the acceleration and deceleration phases. An external potentiometer **P** is used to set the desired tension in the WEB.

Typical applications and bloc schematic

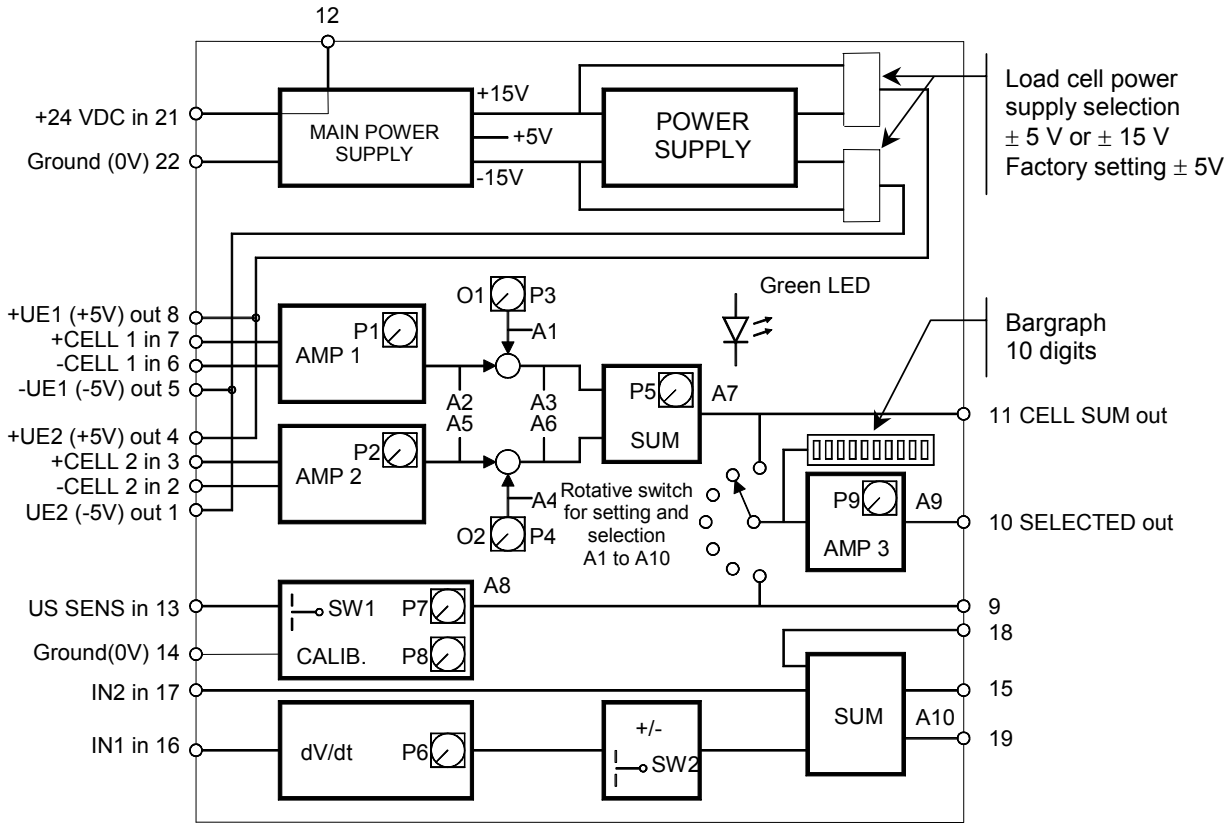
Unwind system in open loop with ultrasonic sensor



MCS2000-IS with 2 load cells and MCS2000-ECA



Bloc schematic



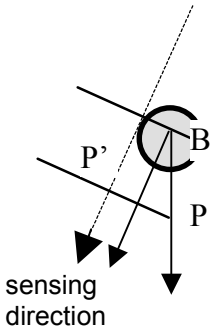
The load cells

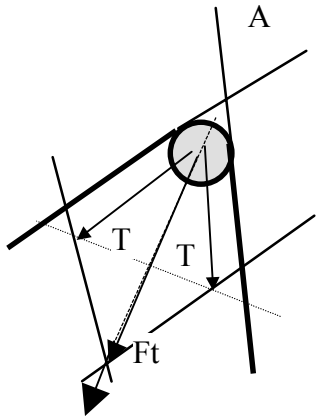
Rating selection

You have to consider **three important factors** to size a load cell correctly:

- the own weight of the shaft
- the max tension in the web
- the web wrapping angle related to the defined resultant force on the load cell

It's always better to place the force sensing direction (indicated by manufacturer) in the web resultant force direction





Weight of the shaft
The weight of the shaft (P) always create a vertical force. The effect of this force has to be reported to force sensing direction (P')

P' = P * cos B

Max tension in the web
The tension in the web is creating a resultant force (Ft) which has to be reported to the force sensing direction
So far the force sensing direction is placed in same direction as the web tension resultant the force applied to the measure system is

Ft = 2 T * cos (A/2)

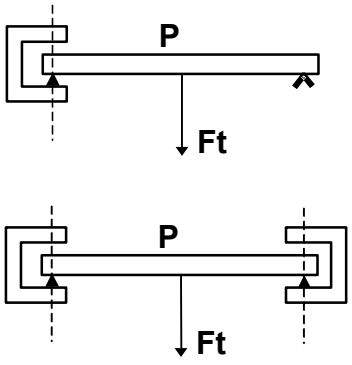
The max force applied on the system measurement then is:

F = Ft + P' = 2T * cos(A/2) + P * cos B

Security coefficient
Depending of the machine type the system measurement has probably to support or to measure some force surges. We generally introduce in the formula a security coefficient K.

The final formula : Fc = 2 K T * cos (A/2) + P * cos B

The above formula is valid for the system measurement. Depending of the mechanical montage the result Fc has to **be divided by 2**. See current case here below :

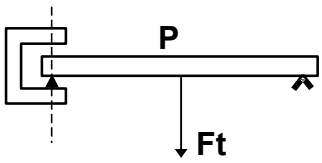


T = Max tension in the web
P = Weight of the sensing shaft
B = Vertical - sensing direction angle
A = Web wrapping angle
Ft= Max force applied to the sensing system
Fc = Max force applied to the sensing system with security coeff.

K = Security coeff taking account force surges and unbalanced force distribution when using 2 load cells.
Usually comprised between 1,2 and 1,5

Load cell setting

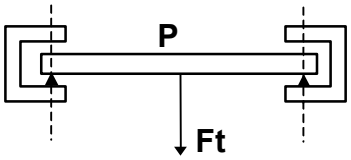
One load cell



In description here below:
Load max = weight of the shaft + load created by the tension
Load min = weight of the shaft

1. Select one channel and put a jumper on the input of the non-active channel (Eg. Channel 1 active)
2. Turn the switch to A2
   - Apply the max load to the shaft
   - **Adjust P1 to get the bargraph fully lit up (10V)**
3. Turn the switch to A3
   - Apply the min load (just the own weight of the shaft)
   - **Adjust P3 to get the bargraph just turned off**
4. Turn the switch to A7
   - Apply the max load to the shaft
   - **Adjust P1 to get the bargraph fully lit up**

Two load cells

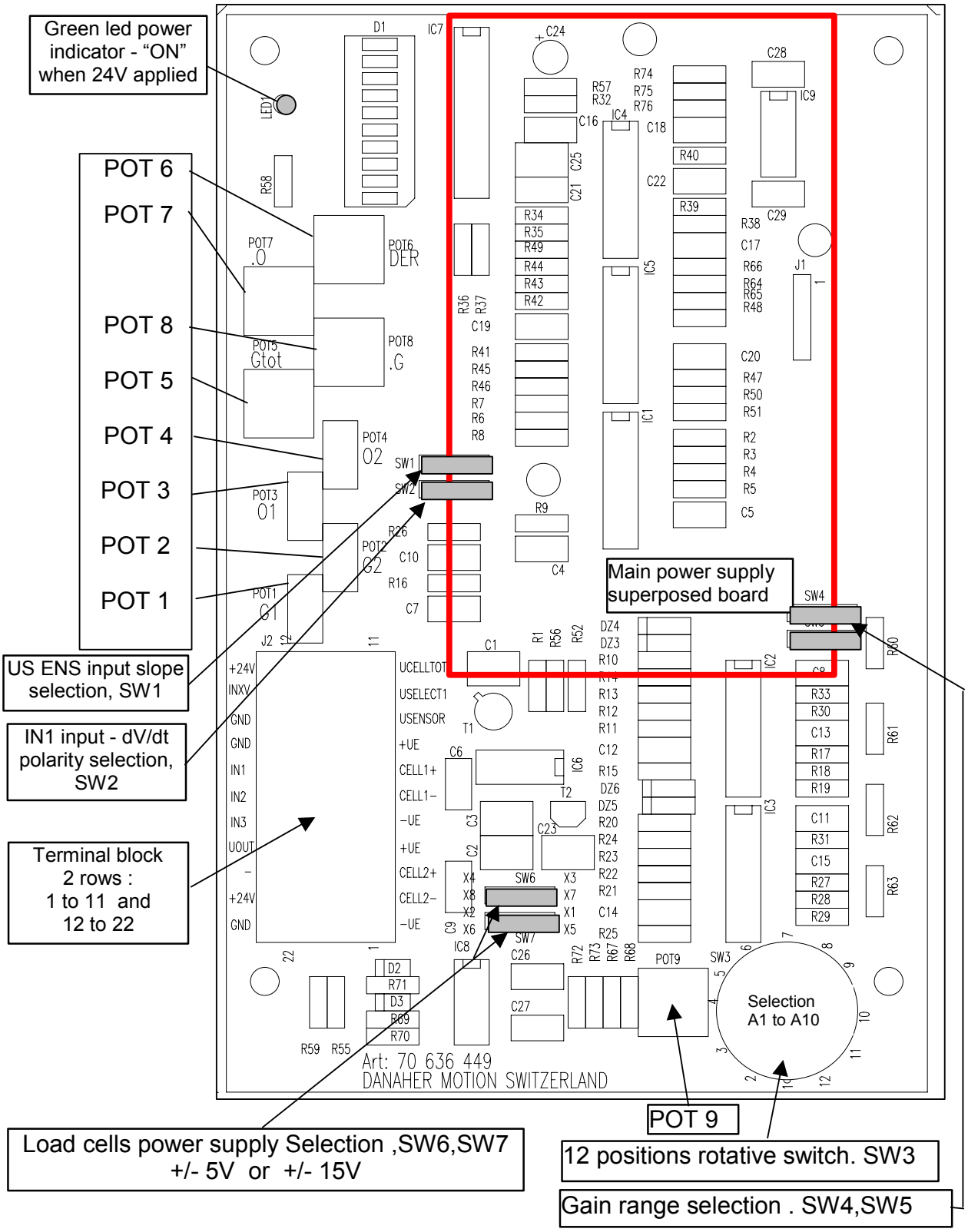


In description here below:
Load max = weight of the shaft + load created by the tension
Load min = weight of the shaft

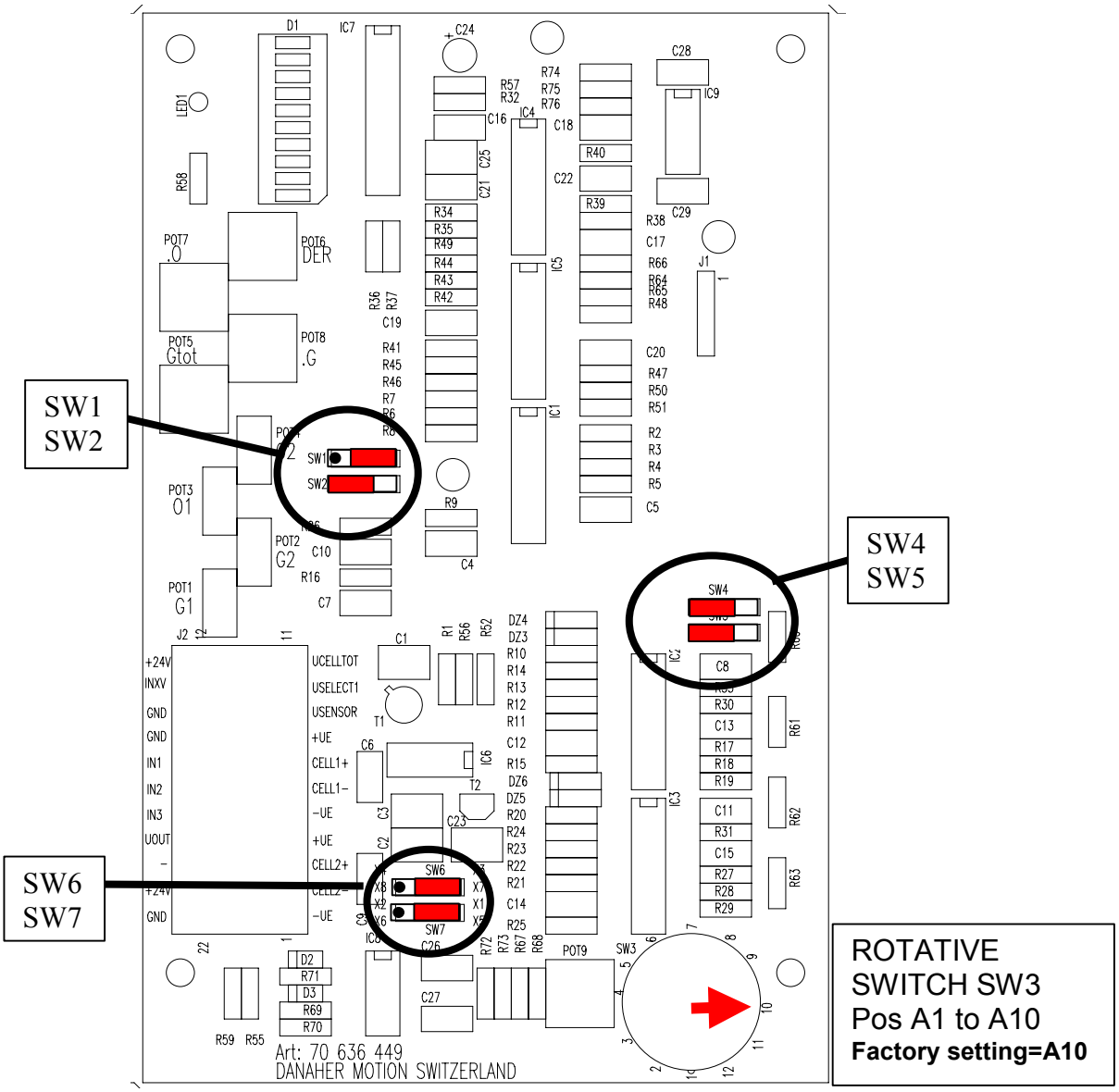
1. Select the first channel to set (Select channel 1 first)
2. Turn the switch to A2 (first channel)
   - Apply the max load to the shaft
   - **Adjust P1 to lit up the first 5 digits of the bargraph**
3. Turn the switch to A3
   - Apply the min load (just the own weight of the shaft)
   - **Adjust P3 to get the bargraph just turned off**
4. Turn the switch to A5 (second channel)
   - Apply the max load to the shaft
   - **Adjust P2 to lit up the first 5 digits of the bargraph**
5. Turn the switch to A6
   - Apply the min load (just the own weight of the shaft)
   - **Adjust P4 to get the bargraph just turned off**
6. Turn the switch to A7
   - Apply the max load to the shaft
   - **Adjust P5 to get the bargraph fully lit up**

MCS2000-IS Layout

Main components location


Green led power indicator - "ON" when 24V applied
POT 6
POT 7
POT 8
POT 5
POT 4
POT 3
POT 2
POT 1
US ENS input slope selection, SW1
IN1 input - dV/dt polarity selection, SW2
Terminal block 2 rows : 1 to 11 and 12 to 22
Main power supply superposed board
Load cells power supply Selection ,SW6,SW7 +/- 5V or +/- 15V
POT 9
12 positions rotative switch. SW3
Gain range selection . SW4,SW5
Selection A1 to A10
Art: 70 636 449
DANAHER MOTION SWITZERLAND

Factory setting



Input slope selection for US SENS		DV/dt polarity compensation	
SW1	To get output decreasing on terminal 9 with input increasing on terminal 13 (**Factory setting**)	**SW2**	To get output decreasing on terminal 19 with input increasing on terminal 16
	To get output increasing on terminal 9 with input decreasing on terminal 13		To get output increasing on terminal 19 with input decreasing on terminal 16 **(Factory setting)**

Load cell power supply			Load cell amplifier gain range			
SW6 SW7		**+5V Factory setting** **- 5V Factory setting**	**UCELL1** **UCELL2**	SW4 SW5		**High gain** **High gain**
SW6 SW7		**+15V**	**UCELL1** **UCELL2**	SW4 SW5		**Low gain** **Low gain**

Inputs / Outputs – Setting specification

Block schematic reference		➔ ➔	Information	Specification
- UE2	**1**	OUT	Power load cell 2	-5 (-15) VDC / max. curent 100 mA, short circuit protected
- CELL 2	**2**	IN	Signal load cell 2	Negative, input impedance 5kΩ, max. gain 1000
+ CELL 2	**3**	IN	Signal load cell 2	Positive, input impedance 5kΩ, max. gain 1000
+ UE2	**4**	OUT	Power load cell 2	+5 (+15) VDC / max. curent 100 mA, short circuit protected
- UE1	**5**	OUT	Power load cell 1	-5 (-15) VDC / max. curent 100 mA, short circuit protected
- CELL 1	**6**	IN	Signal load cell 1	Negative, input impedance 5kΩ, max. gain 1000
+ CELL 1	**7**	IN	Signal load cell 1	Positive, input impedance 5kΩ, max. gain 1000
+ UE1	**8**	OUT	Power load cell 1	+5 (+15) VDC / max. curent 100 mA, short circuit protected
US SENS OUT	**9**	OUT	Calibrated signal	0-10 VDC, 10 mA, short circuit protected
SELECTED OUT	**10**	OUT	Selection 9 or 11	0-10 VDC, 10 mA, short circuit protected
CELL SUM	**11**	OUT	Calibrated load cell	0-10 VDC, 10 mA, short circuit protected
+24VDC-SENS	**12**	OUT		+24 VDC / max. current capacity – 300 mA
US SENS	**13**	IN	Ultrasonic or other	Input impedance 10 kΩ, Delta max. 9 VDC, min. 1 VDC, 0 VDC connect to Ground
GROUND	**14**	--		General ground of the circuitry
GROUND	**15**	--		General ground of the circuitry
IN 1	**16**	IN	For dV/dt compensation	Input impedance 10 kΩ, max. 10 VDC
IN 2	**17**	IN	External access	Input impedance 10 kΩ, max. 10 VDC
IN 3	**18**	IN	External access	Input impedance 10 kΩ, max. 10 VDC
VREF	**19**	OUT	Sum IN1, 2 and 3	Max. 10 VDC, 10 mA, short circuit protected
--	**20**	--		Free
+24 VDC	**21**	IN	Main supply	Power supply board +24 VDC ± 2 V Capacity 300 mA + output 12
GROUND	**22**	--		0 V for power supply input
SWITCHES	**SW1 to SW7**			See explanation pages 9 and 10
POT G1	**P1**			Gain load cell 1 / max. 1000 – min. 450
POT G2	**P2**			Gain load cell 2 / max. 1000 – min. 450
POT O1	**P3**			Offset load cell 1 / ± 5 V
POT 02	**P4**			Offset load cell 2 / ± 5 V
POT G TOT	**P5**			Gain load cell 1 + 2 / max. gain 2 – min gain 1
POT	**P6**			Gain on dV/dt correction – 0 to 10 V
POT 0	**P7**			Offset for US SENS input 13, max. 2.5 V
POT G	**P8**			Gain for US SENS input 13, max. 5, min. 1
POT	**P9**			Gain for SELECTED OUT, output 10 max. 1.1 / min 0.2
AMP 1				Amplifier channel 1
AMP 2				Amplifier channel 2

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